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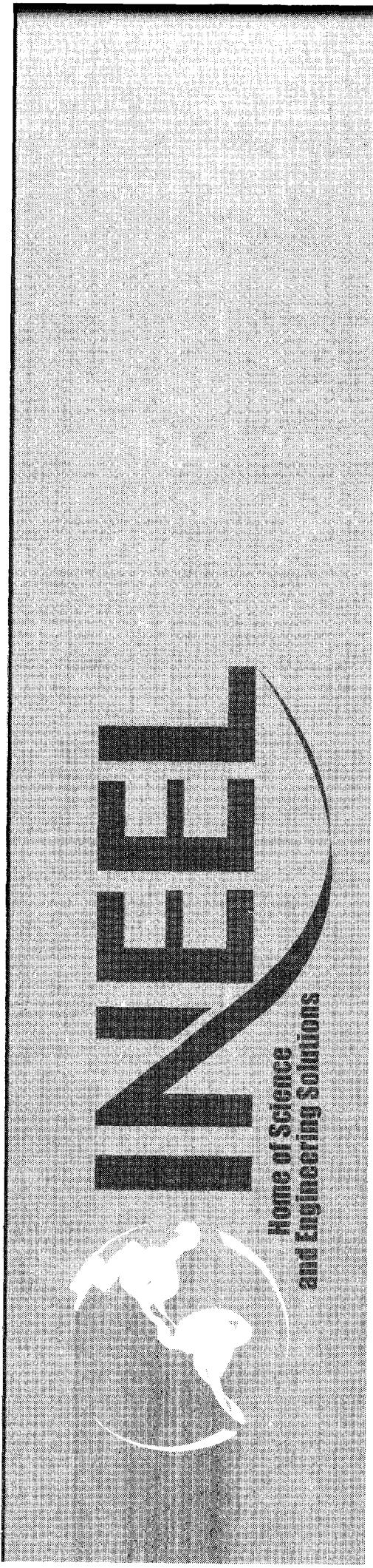

Fiscal Year 2000 Groundwater Monitoring Annual Report Test Area North, Operable Unit 1-07B

September 2001

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Groundwater Monitoring Annual Report
Test Area North, Operable Unit 1-07B

September 2001

Idaho National Engineering and Environmental Laboratory
Environmental Restoration Program
Idaho Falls, Idaho 83415

Prepared for the
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Groundwater Monitoring Annual Report
Test Area North, Operable Unit 1-07B

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September 2001

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ABSTRACT

This report presents organic, radiological, and water-level data collected in support of groundwater monitoring requirements at Test Area North, Operable Unit 1-07B. During Fiscal Year 2000, groundwater monitoring followed the statistical sampling plan where wells are sampled relative to routine sampling to obtain a strategic set of monitoring data for the purpose of evaluating plume dynamics and the effectiveness of remedial actions. This document is intended to describe groundwater sampling activities and summarize analytical results. Data trends and interpretations will be presented later in the Fiscal Year 2001 Periodic Remedy Performance Report.

CONTENTS

FIGURES

TABLES

ACRONYMS

amsl	above mean sea level
ASTU	air stripper treatment unit
DAR	Document Action Request
DCE	dichloroethene
DOE-ID	Department of Energy Idaho Operations Office
DQO	data quality objective
EPA	Environmental Protection Agency
ER	Environmental Restoration
FY	fiscal year
GWMP	groundwater monitoring plan
INEEL	Idaho National Engineering and Environmental Laboratory
ISB	in situ bioremediation
MDA	minimum detectable activity
NPTF	New Pump and Treat Facility
OU	operable unit
PCE	perchloroethene (tetrachloroethene)
QA	quality assurance
QC	quality control
RPD	relative percent difference
SAP	sample analysis plan
SDG	sample delivery group
SMO	Sample Management Office
SOW	Statement of Work
TAN	Test Area North
TCE	trichloroethene

TPR	technical procedure
TSF	Technical Support Facility
USGS	Unites States Geological Survey
VOC	volatile organic compound

Fiscal Year 2000
Groundwater Monitoring Annual Report
Test Area North, Operable Unit 1-07B

1. INTRODUCTION

Groundwater monitoring for Fiscal Year (FY) 2000 has been conducted per the requirements presented in *Fiscal Year 1999 and 2000 Groundwater Monitoring Plan Test Area North, Operable Unit 1-07B* (Idaho National Engineering and Environmental Laboratory [INEEL] 1999), hereinafter referred to as the groundwater monitoring plan. During FY 2000, groundwater monitoring followed an approach where sampling was conducted at selected wells in the Test Area North (TAN) plume wellfield. Analytical results from the sampling are intended to be used to monitor and evaluate overall plume dynamics in response to natural processes and remediation activities.

Data quality objectives (DQOs) outlined in the groundwater monitoring plan for the FY 2000 sampling event integrated modified data requirements described in the *Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Fuel Contamination in Groundwater* (Wiedemeier et al. 1996), the *Technical Protocol for Evaluation of Natural Attenuation of Chlorinated Solvents in Groundwater* (Environmental Protection Agency [EPA] 1998), and the *Sampling and Analysis Plan for the Enhanced In-Situ Bioremediation Field Evaluation Test Area North, Operable Unit 1-07B* (Sorenson and Bullock 1998). The DQOs for this project were met.

1.1 Purpose

In accordance with Section 7.3 of the groundwater monitoring plan, this document has been organized to present groundwater monitoring data collected during FY 2000, as well as historical data for wells included in the groundwater monitoring plan. The purpose of the FY 2000 report is to present and summarize critical data regarding contaminant concentrations. Analysis and interpretation of data trends throughout the plume were presented in site conceptual model update reports (INEEL 2000a) and in the future will be presented in the Periodic Remedy Performance Report to be written in FY 2002. Analysis and interpretation of data specific to the hot spot wells will be presented in an In Situ Bioremediation Annual Report due to be completed in September or October of 2001.

Section 3.3 of this document has been included to present the interpretation of groundwater elevation data. The addition of this section addresses Section 3.4 of the groundwater monitoring plan, which discusses the need to confirm historical water level trends.

2. STATISTICAL GROUNDWATER MONITORING OBJECTIVES

The overall objective of statistical sampling is to track spatial and temporal trends in contaminants originating from the Technical Support Facility (TSF) injection well TSF-05. The statistical sampling approach is fully described and detailed in the groundwater monitoring plan (INEEL 1999). Wells selected for the statistical monitoring program were those that are located roughly along the central axis of the trichloroethene (TCE) plume and that are screened in the upper half of the aquifer, which is the zone where waste was injected from TSF-05. Data from other wells located near the plume interior and boundary were selected to support evaluation of mass flux along a transect perpendicular to the plume axis and evaluate longitudinal and transverse plume growth and stability.

Four specific objectives for the statistical sampling program have been identified based upon review of existing data and on literature review of natural attenuation of chlorinated hydrocarbons. These objectives include:

1. Evaluate spatial trends in molar ratios of volatile organic compounds (VOCs)

2. Evaluate spatial trends in TCE concentrations

3. Evaluate temporal trends in TCE concentrations

4. Estimate sources of variability in measured values.

These are the original objectives established during the development of the groundwater sampling program for TAN in 1996. The subsequent 5 years of data gathering and analysis have contributed to meeting these objectives and will be detailed in the Periodic Remedy Performance Report.

A total of 22 wells were sampled in or near the TCE plume shown on Figure 2-1. The area has been divided up in three different sections based on concentration gradients in the TCE plume extending downgradient of TAN. Section I contains the area surrounding the injection well TSF-05 and all wells from TAN-37 westward. Section II contains the area eastward from TAN-28 to the TAN fenced boundary. Section III contains the area from the TAN fenced boundary to beyond the leading edge of the plume. Each section contains the wells listed in Table 2-1. Dividing the plume according to these sections assists in drawing relationships between the interpretation of data from a group of wells with specific processes that may be affecting plume dynamics in each particular section. Refer to Figure 2-1 for section boundary locations.

Specific DQOs for groundwater monitoring were developed as a result of evaluating data requirements with respect to defined zones within the TCE plume. Within these zones, each well has also been grouped in one of four subdivisions: (1) axial, (2) boundary, (3) interior, and (4) exterior. The section subdivisions have been added to describe the position of a given well based on its plume-referenced location. For a given plume section, axial wells are located approximately near the plume axis, interior and boundary wells are situated within or immediately outside the plume, and exterior wells are located well outside the defined plume. Grouping wells by subdivision will assist in evaluating plume dynamics by identifying changes for a specific part of the plume and surrounding well field. Section 3 of this report summarizes contaminant of concern data for all wells based on location in the groundwater plume.

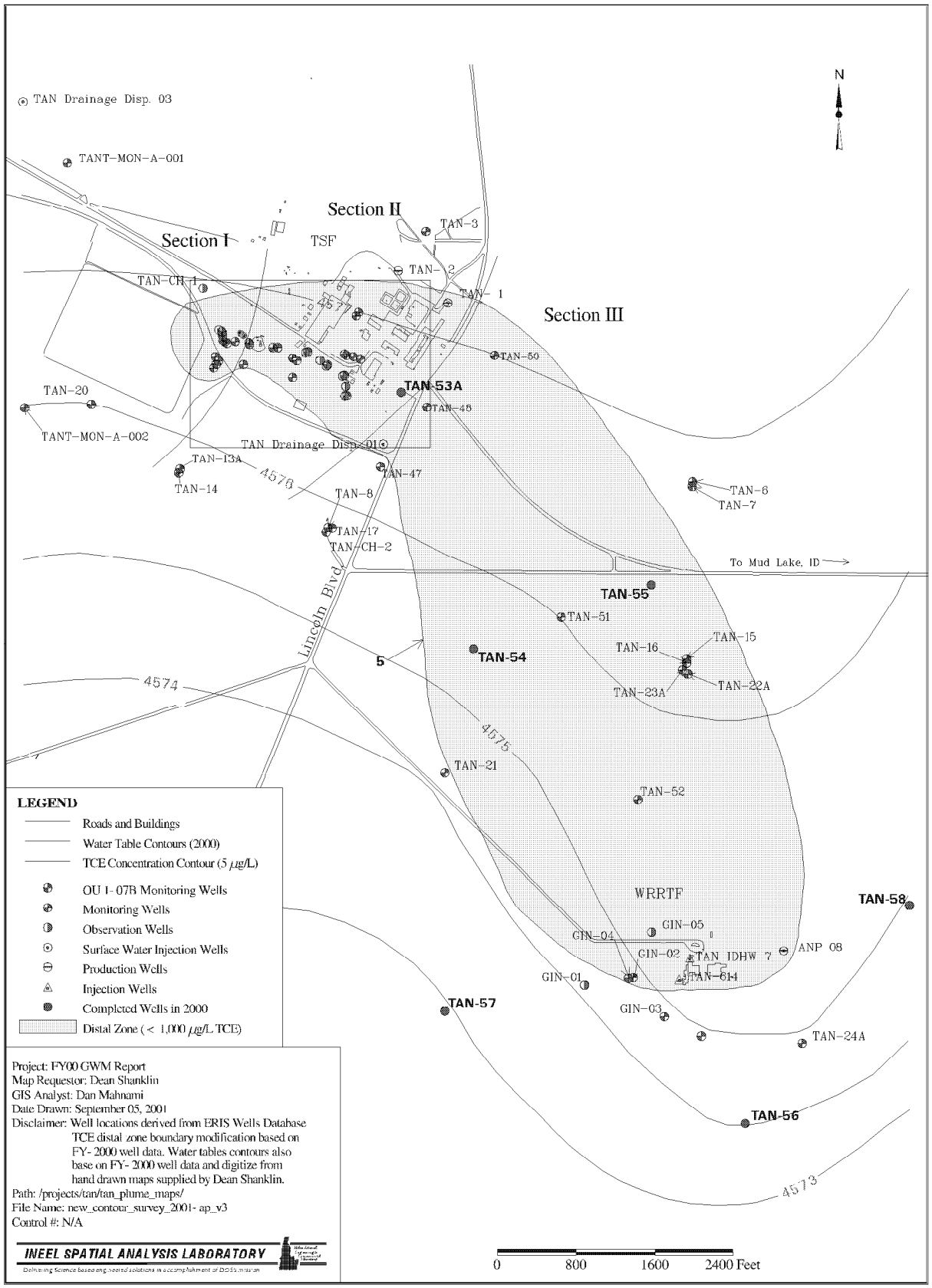

Figure 2-1. TCE concentration contour map for Test Area North.

Table 2-1. Wells sampled in each section.

Section I	Section II	Section III
TAN-25	TAN-28	ANP-8
TSF-05	TAN-29	GIN-4
TAN-D3	TAN-30A	MW-2
	TAN-33	TAN-15
	TAN-38	TAN-16
	TAN-39	TAN-24A
	TAN-40	TAN-47
	USGS-24	TAN-48
		TAN-50
		TAN-51
		TAN-52

The FY 2000 groundwater monitoring data collection occurred at different well locations to satisfy the DQOs developed in the groundwater monitoring plan (GWMP). Table 2-2 presents the DQOs developed in the GWMP (INEEL 1999) and includes specific analytical information (method, precision, potential problems) and plume well locations for collection of each sample.

2.1 Sampling Completion Status

The sampling plan for FY 2000 included 24 wells. Of these, two (TAN-54 and TAN-55) were not sampled because they were still under construction. Well TSF-05 was designated to be sampled in triplicate; however, only one sample was taken because of access restrictions due to purging/sampling equipment temporally hung up down-hole. Also, three trip blanks were omitted.

Samples for all other wells were collected according to the groundwater monitoring plan and documented in Logbooks ER-55-00 and ER-56-00. At the request of the Agencies, additional radionuclide samples in the vicinity of the hot spot were also collected. Specifically, alpha spectrometry for uranium isotopes was included at Wells TSF-05, TAN-25, TAN-37, TAN-28, and TAN-30A. These analyses were incorporated into the groundwater monitoring plan through a Document Action Request (DAR) (DAR-1839); results of the analyses are intended to be used to monitor the effect of remedial technologies on the distribution and/or mobilization of radionuclides in the vicinity of the hot spot and immediately downgradient.

Table 2-2. Data quality objectives for TAN groundwater monitoring.

Analysis	Data Use	Proposed Analytical Method	Section Plume Location	Precision	Potential Data Quality Problems
Volatile Organic Compounds (Target Compound List = PCE, TCE, cis/trans-DCE, vinyl chloride)	Evaluate changes in concentration of contaminants with respect to plume dynamics; observe dechlorination products.	SW 8260	I, II, III	±25%	Volatilization during shipment and biodegradation caused by improper preservation.
Temperature/pH/ Conductivity/Dissolved Oxygen/Oxidation Reduction Potential	Measure water quality parameters to evaluate conditions for natural attenuation and in situ bioremediation.	Groundwater sampling flow through cell	I, II, III	±10%	Improperly calibrated instrument.
Tritium	Used to assess geochemical changes not due to remediation processes.	Radiochemistry—Tritium in water (Guidance from ER-SOW-163)	I, II, III	±25%	None identified.
Uranium	Evaluate changes in radioisotopes within the hot spot.	Guidance from ER-SOW-163	TSF-05, TAN-25, TAN-37, TAN-28, TAN-30A	±25%	Must be preserved; large sample volume required.

Modified after Wiedemeier et al. 1996 and Sorenson and Bullock 1998.

ER = Environmental Restoration SOW = Statement of Work

2.2 Deviation from Groundwater Monitoring Plan

The statistical sampling approach for FY 2000 included the collection of various analytical parameters at a selected set of wells located in the vicinity of the TAN plume. Analytical results will subsequently be used to assess plume dynamics and support the effectiveness of natural degradation processes and remediation activities. Table 2-3 lists all the planned samples, including trip and field blanks. Of 135 samples planned, 112 were collected for a percent completion of 83%. Two of the three planned sampling rounds from TSF-05 were not conducted because of access restrictions due to purging/sampling equipment hung up down-hole, and the six samples planned for Wells PNA-3 (TAN-54) and PNA-5 (TAN-55) were not collected because the wells were still under construction (refer to boldfaced wells on Figure 2-1). Excluding these samples, 91% of all planned samples were collected.

During the summer and fall of 2000, the TAN-38, TAN-39, and TAN-40 monitoring wells were reconfigured at the surface to accept high volume extraction pumps as part of the New Pump and Treat Facility (NPTF). Sample collection from the TAN-38 and TAN-39 monitoring wells were delayed from June 6 until October 10, 2000, due to construction activities. The planned sample collection from the TAN-40 monitoring well was not affected by the construction activities. Extraction pumps for the three wells were installed in November of 2000, approximately one month after all samples were collected.

Deviations to the original approach were incorporated into the monitoring activities and documented as a DAR. The DARs that affected FY 2000 groundwater monitoring are included in Table 2-4.

2.3 Water Level Measurements

The frequency of water level measurements was reduced from quarterly to annually beginning in FY 1999 as described in the groundwater monitoring plan. For FY 2000, the annual water level measuring event occurred on November 29, 2000. The event was originally scheduled to take place on August 26, 2000. Water level measurement activities began on the scheduled date but were terminated prior to completion when it was realized that the field crew did not have all required access keys and the discovery that measuring point locations on some wells were either inadequately marked or were located on couplings that may have been relocated sometime during the year. To ensure accuracy in the water level measurements, an activity was planned and implemented in November of 2000 to relocate and survey all new measuring points at each monitoring well. New measuring points for each well were located along the top of each protective casing and resurveyed. New coordinates and elevations for the monitoring well measuring points are listed in Appendix A. The horizontal datum used is NAD27, Idaho East Zone, State Plane Coordinates in U.S. Survey Feet. The vertical datum used is NGVD29 in U.S. Survey Feet.

On the day water level measurements were taken, the TAN production wells were in operation as well as the air stripper treatment unit (ASTU), which may have contributed minor man-made effects on the measured groundwater levels. Injection activities, amounting to the injection of approximately 12,000 gallons of potable water/lactate mix in support of in situ bioremediation (ISB) operations at TSF-05, took place on November 8, causing little, if any, effect on water level measurements in the surrounding area on November 29 confirmed by transducer data showing that water levels at and near TSF-05 return to ambient levels within hours of the end of injection. In addition, no extraction/reinjection activities occurred in support of the NPTF, and no activities had taken place at the University of Idaho test wells (TAN-34 and -35).

Table 2-3. Planned vs. performed sampling for FY 2000.

		Sampling Date		Sampling Planned / Performed				
Location	Section	Planned[a]	Actual	^{3}H	U	VOCs	VOCs MS/MSD	Notes
TSF-05	Section I	6/13/00	6/5/00	1/1	1/0	1/0		Access Restriction
TSF-05	Section I	7/17/00	none	1/0	1/0	1/0		
TSF-05	Section I	8/9/00	none	2/0	2/0	2/0		
TAN-25	Section I	6/13/00	6/5/00	1/1	1/1	1/1		
TAN-25	Section I	7/17/00	7/6/00	1/1	1/1	1/1		
TAN-25	Section I	8/9/00	7/31/00	1/1	1/1	1/1		
TAN-D3	Section I	6/5/00	6/28/00	2/2		2/2		
TAN-28	Section II	6/5/00	6/5/00	1/1		1/1		
TAN-28	Section II	7/5/00	7/5/00	1/1		1/1		
TAN-28	Section II	8/1/00	8/28/00	1/1		1/1		
TAN-29	Section II	6/5/00	6/5/00	1/1		1/1		
TAN-30A	Section II	6/13/00	6/5/00	1/1	1/1	1/1		
TAN-30A	Section II	7/17/00	7/5/00	1/1	1/1	1/1		
TAN-30A	Section II	8/9/00	7/31/00	1/1	1/1	1/1		
TAN-33	Section II	6/7/00	6/21/00	1/1		1/1		
TAN-38	Section II	6/6/00	10/10/00	2/2		1/1		
TAN-39	Section II	6/6/00	10/11	1/1		1/1		
TAN-40	Section II	10/9/00	10/12/00	1/1		0/1	1/0	NPTF Construction
USGS-24	Section II	6/7/00	6/26/00	1/1		1/1		
USGS-24	Section II	7/10/00	7/12/00	2/2		2/2		
USGS-24	Section II	8/3/00	8/2/00	1/1		1/1		
QC Trip Blank	Section II	6/13/00				1/1		
QC Trip Blank	Section II	6/6/00				1/1		
QC Trip Blank	Section II	6/7/00				1/0		
QC Trip Blank	Section II	7/11/00	7/13/00			1/1		
QC Trip Blank	Section II	7/17/00	7/19/00			1/1		
QC Trip Blank	Section II	7/5/00	7/25/00			1/1		
QC Trip Blank	Section II	8/9/00	8/8/00			1/1		
QC Trip Blank	Section II	8/3/00	8/2/00			1/1		
QC Trip Blank	Section II	8/14/00	8/15/00			1/1		
QC Trip Blank	Section II	10/11/00	8/21/00			1/1		
QC Trip Blank	Section II	10/11/00	10/10/00			1/1		
QC Field Blank	Section II	10/11/00	6/26/00	1/1	1/0	1/1		
QC Field Blank	Section II	10/11/00	10/10/00	1/1	1/0	1/1		
GIN-4	Section III	6/19/00	6/12/00	1/1		1/1		
GIN-4	Section III	7/17/00	7/19/00	1/1		1/1		
GIN-4	Section III	8/14/00	8/1/00	1/1		1/1		

Table 2-3. (continued).

Location	Section	Sampling Date		Sampling Planned / Performed				Notes
		Planned[a]	Actual	^{3}H	U	VOCs	VOCs MS/MSD	
MW-2	Section III	6/19/00	6/13/00	1/1		1/1		
MW-2	Section III	7/17/00	7/13/00	1/1		1/1		
MW-2	Section III	8/14/00	8/1/00	1/1		0/0	1/1	
TAN-15	Section III	6/14/00	6/12/00	1/1		1/1		
TAN-16	Section III	6/14/00	6/14/00	1/1		0/0	1/1	
TAN-16	Section III	7/13/00	7/13/00	1/1		1/1		
TAN-16	Section III	8/9/00	8/1/00	1/1		1/1		
TAN-24A	Section III	6/19/00	6/12/00	1/1		1/1		
TAN-24A	Section III	7/17/00	7/19/00	1/1		1/1		
TAN-24A	Section III	8/14/00	8/1/00	1/1		1/1		
TAN-47	Section III	6/13/00	7/10/00	1/1		1/1		
TAN-47	Section III	7/12/00	7/18/00	1/1		1/1		
TAN-47	Section III	8/8/00	8/15/00	1/1		1/1		
TAN-48	Section III	8/8/00	6/19/00	1/1		1/1		
TAN-48	Section III	7/10/00	7/19/00	1/1		1/1		
TAN-48	Section III	8/3/00	8/7/00	2/2		2/2		
TAN-50	Section III	6/13/00	7/11/00	1/1		1/1		
TAN-50	Section III	7/12/00	7/25/00	1/1		1/1		
TAN-50	Section III	8/8/00	8/21/00	1/1		1/1		
TAN-51	Section III	6/12/00	6/20/00	1/1		1/1		
TAN-51	Section III	7/11/00	8/18/00	1/1		1/1		
TAN-51	Section III	8/7/00	8/17/00	1/1		1/1		
TAN-52	Section III	6/12/00	6/27/00	1/1		1/1		
TAN-52	Section III	7/11/00	8/9/00	1/1		0/0	1/1	
TAN-52	Section III	8/7/00	8/23/00	1/1		1/1		
ANP-8	Section III	6/12/00	6/13/00	1/1		1/1		
ANP-8	Section III	7/11/00	7/12/00	1/1		1/1		
ANP-8	Section III	8/7/00	8/22/00	1/1		1/1		
QC Field Blank	Section III	6/6/00	7/19/00	1/1	1/0	1/1		
QC Field Blank	Section III	7/12/00	8/17/00	1/1	1/0	1/1		
QC Field Blank	Section III	8/14/00		1/1	1/0	1/0		
QC Trip Blank	Section III	6/7/00	6/13/00			1/1		
QC Trip Blank	Section III	7/11/00	6/20/00			1/1		
QC Trip Blank	Section III	8/9/00	6/27/00			1/1		
QC Rinsate	Section III	6/5/00	6/27/00	1/1	1/1	1/1		
QC Rinsate	Section III	7/11/00	7/25/00	1/1	1/1	1/1		
QC Rinsate	Section III	8/14/00	8/17/00	1/1	1/1	1/1		
PNA-3 (TAN-54)	Section III	6/19/00		1/0		1/0		Well Under Construction

Table 2-3. (continued).

Location	Section	Sampling Date		Sampling Planned / Performed				Notes
		Planned[a]	Actual	^{3}H	U	VOCs	VOCs MS/MSD	
PNA-3 (TAN-54)	Section III	7/17/00		1/0		1/0		
PNA-3 (TAN-54)	Section III	8/9/00		1/0		1/0		
PNA-5 (TAN-55)	Section III	6/13/00		1/0		1/0		Well Under Construction
PNA-5 (TAN-55)	Section III	7/17/00		1/0		1/0		
PNA-5 (TAN-55)	Section III	8/14/00		1/0		1/0		

Note: the shaded cells indicate deviations from planned activities.

a. From Plan Table Number: INEEL-99-00021S, SAP Number: INEEL/EXT-99-21, dated 10/09/00, Rev. 10.0 (Funk 2000).

Table 2-4. DARs affecting FY 2000 groundwater monitoring.

DAR Number	Description	Justification
ER-DAR-2088 February 2000	Add text to Table 2-1 of the Groundwater Monitoring Plan.	Update the table to include dissolved gas sampling at TAN.
	Add text to Table 3-1 of the Groundwater Monitoring Plan.	Update the table to include dissolved gas sampling at TAN.
	Add a new section to describe other sampling activities at TAN.	Add section to establish how other sampling activities at TAN will be handled as they arise.
	Add text to Table 4-2 of the Groundwater Monitoring Plan.	Update the table to include dissolved gas sampling at TAN.
	Add text to Section 5.2.1 indicating that new SAP tables will be included in Appendix A.	Add text to show any new SAP tables will be included in Appendix A.
	Add a reference to the reference section.	Reference was added to text and needs to be added to reference section.
	Add a new SAP table to Appendix A for dissolved gas sampling.	SAP table is included per items above.
ER-DAR-1978 November 1999	Add development water verbiage within no-longer contained-in determination sampling paragraph found in Section 3.3.	Include well development activities with the no-longer contained-in determination sampling.
ER-DAR-1839 August 1999	Add analyses for uranium isotopes at TSF-05, TAN-25, TAN-37, TAN-28, and TAN-30A. Add TSF-05, TAN-25, and TAN-30A to statistical monitoring.	Alpha spectrometry for uranium isotopes will be included to monitor the effects of treatability studies and the final selected remedial technology on the distribution or mobilization of radionuclides (specifically ^{234}U).
	Add TSF-05 and TAN-25 for statistical analyses.	Include monitoring (specifically uranium isotopes) for wells located near source area.
	Add TAN-30A for statistical analysis.	Include monitoring (specifically uranium isotopes) for wells located downgradient of source area.

Table 2-4. (continued).

DAR Number	Description	Justification
ER-DAR-1759 June 1999	Delete nitrate from major anion list; add separate nitrate analysis at end of table.	Nitrate analysis will be performed in the OU 1-07B field lab trailer.
	Add Wells TAN-10A and TAN-27 to footnote.	These wells are part of bioremediation treatability study and should be included in select well group.
	Add paragraph at end of section.	Include micropurge as groundwater sampling technique for treatability study wells.
	Change sample 1WS009 to DUP and sample 1WS010 to GRAB and change sample 1WS041 to DUP and sample 1WS042 to GRAB.	Keep SAP tables consistent with discussion of sample description, found in Section 5.1.
	Change samples 1WS204, 1WS206, and 1WS208 to DUP; delete sample 1WS209.	Changing GRAB to DUP to convey that AT1 and AT2 will both be analyzed for VOCs; delete rinsate because no sampling equipment will be used.

Water levels in a total of 70 wells were measured. Deviations from the planned list, contained in the groundwater monitoring plan, are given in Table 2-5.

Table 2-5. Deviation from the groundwater monitoring plan for water level measurements.

Additions	Omitions	Notes
TAN-54	ANP-8, IET Disposal, TAN-3	No access granted.
TAN-55	TAN-D2	Has stainless steel box attached to casing top. Unable to determine elevation during survey.
TAN-56	TAN-1, TAN-2	Production well in use
TAN-57	TAN-17	Lock corroded, unable to access.
TAN-58	TAN-25, TAN-26	Hantavirus concern. No water Level Access Tube.
TAN-MON-A001	TAN-29	Extraction well. Bolted flanged covering. No access.
	TAN-34	University of Idaho well. Packer stuck downhole. No access.
	TAN-35	University of Idaho well. No well key available for access.
	TAN-38, -39, -40	NPTF construction area. New extraction pumps installed. No access.
	TSF-05	No water Level Access Tube.
	USGS-16	Plan misprint. Should read "USGS-26."

3. ANALYTICAL REQUIREMENTS AND RESULTS

During FY 2000, samples were collected and analyzed for the analytical parameters listed in Table 3-1. Because each well location included a specific analyte list that was taken from Table 3-1, the groundwater monitoring plan should be referenced for exact parameters and locations. The analyses were performed in accordance with established EPA methods, with the exception of radionuclide analyses. The radionuclide analyses were performed in accordance with the *Idaho National Engineering Laboratory Sample Management Office Statement of Work for Radionuclide Analysis* (INEL 1995). This document establishes the required detection limits and quality assurance requirements for the analytical methods to be employed. All analytical results underwent a cursory review by a Sample Management Office (SMO) chemist under the guidance of Technical Procedure (TPR)-79 or current guidance document form. The cursory review process checked to make sure that: (1) the analyses requested in the TOS/SOW were performed and reported, (2) authorized analytical methods were used, (3) analysis holding times were met, and (4) the contractually agreed upon turnaround times were met. In conjunction with the cursory review, SMO data management personnel verify the data uploaded into the Environmental Restoration Information System are accurate according to the analytical data packages.

Past reports have stated that analytical results were validated to Level "C." However, Level "C" has frequently been misinterpreted, misunderstood, and/or misrepresented to be analytical method data validation (AMDV) and gave many data users the false sense that their data were "validated." In FY 2000, Level "C" validation terminology was eliminated and replaced with a Cursory Review. The Cursory Review provides the same level of data review that was provided with the old Level "C" validation.

Appendix B includes the historical Operable Unit (OU) 1-07B database updated with FY 2000 analytical data. The data tables are organized so that contaminant/geochemical changes through time for any well location can be readily observed. Result tables, from which Appendix B was created, compile all other relevant sampling information generated by the SMO (e.g., sample number, sample delivery group number, and dilution factor).

3.1 Organic Analyses

The primary VOCs of concern include vinyl chloride, cis- and trans-dichloroethene (DCE), TCE, and tetrachloroethene (PCE). Tables 3-2, 3-3, and 3-4 include VOC data for each of the wells sampled during FY 2000 monitoring. The tables are organized based on plume section to present data in a fashion that is consistent with the groundwater monitoring plan. It is clearly observable that the highest TCE concentrations occur in plume Section II, while increased concentrations in the TCE degradation products are evident in plume Section I. Contaminant concentrations and locations have been influenced by the Ground Water Treatment Facility, which operated from February 1994 until October of 1998. They continue to be influenced by the continuing in situ bioremediation (ISB) activities, which began in January of 1999, and by the operation of the ASTU, which began in November of 1998 and suspended in December of 2000. Changes in TCE concentrations (based on the historical data tables in Appendix B and project understanding of contaminant transport in the system) from Wells TSF-05 to TAN-48 are illustrated in Figure 3-1. A more detailed review of the treatability study and TCE degradation processes is documented in the Field Demonstration Report (INEEL 2000b) and the Site Conceptual Model (INEEL 2000a) and will be further developed in an ISB annual report.

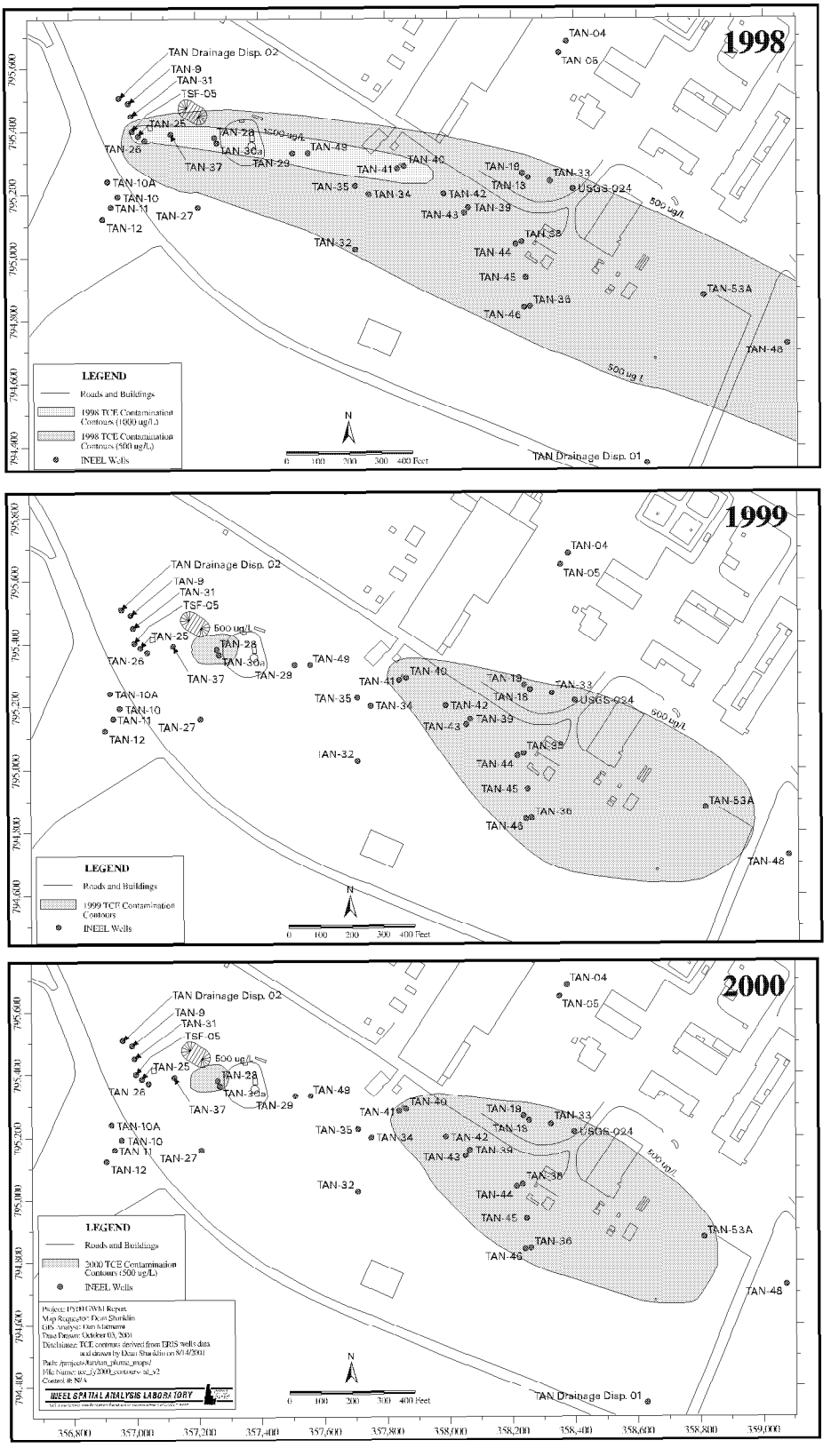

Figure 3-1. TCE concentration contours from Wells TSF-05 to TAN-48 for the years 1998, 1999, and 2000.

Table 3-1. Specific analytical requirements and methods for organic analysis.

Analytical Parameter	Analytical Method	Laboratory Performing Analysis
VOCs (PCE, TCE, cis-DCE, trans-DCE, vinyl chloride)	SW-846 Method 8260A (EPA 1986)	Quanterra Incorporated, St. Louis

Table 3-2. Summary of VOC analytical results for TAN groundwater monitoring wells located in plume Section I.

Well Name	Sample Collection Date	PCE (µg/L)	TCE (µg/L)	Cis-DCE (µg/L)	trans-DCE (µg/L)	Vinyl Chloride (µg/L)
TAN-25	6/5/00	—	<10	43.1	423.4	<10
TAN-25	7/6/00	<10	<10	22.7	398.8	<10
TAN-25	7/31/00	—	<10	69.5	490.5	42.0
TAN-D3	6/28/00	1 U[b]	0.7343 J[c]	0.5 U	0.5 U	2 U
TAN-D3 Dup	6/28/00	1 U	0.7456 J	0.5 U	0.5 U	2 U
TSF-05	6/5/00	—	<10	77.8	782.9	115

U = non-detect

J = estimated quantity.

Table 3-3. Summary of VOC analytical results for TAN groundwater monitoring wells located in plume Section II.

Well Name	Sample Collection Date	PCE (µg/L)	TCE (µg/L)	cis-DCE (µg/L)	trans-DCE (µg/L)	Vinyl Chloride (µg/L)
TAN-28	6/5/00	<10	621.9	187.5	134.2	<10
TAN-28	7/5/00	<10	579.4	173.4	122.4	<10
TAN-28	8/28/00	<10	768.3	192.3	144.5	<10
TAN-29	6/5/00	<10	155.2	20	<10	<10
TAN-30A	6/5/00	<10	177.6	43.0	35.5	<10
TAN-30A	7/5/00	12.2	202.8	48.3	33.2	<10
TAN-30A	7/31/00	<10	192.4	47.8	35.5	<10
TAN-33	6/26/00	36.30	410.9	32.20	14.02	2 U
TAN-38	10/10/00	23.4	576.6	48.18	20.27	2 U
TAN-39	10/11/00	42.18	660.5	60.79	25.31	2 U
TAN-40	10/12/00	9.418	283.3	28.26	13.09	2 U
USGS-24	6/26/00	44.48	379.9	29.33	12.69	2 U
USGS-24	7/12/00	39.02	619.0	34.22	13.30	40 U
USGS-24 Dup	7/12/00	43.50	603.7	33.16	14.89	40 U
USGS-24	8/2/00	29.04	539.0	47.53	20.06	40 U

U = non-detect

Table 3-4. Summary of VOC analytical results for TAN groundwater monitoring wells located in plume Section III.

Well Name	Sample Collection Date	PCE (µg/L)	TCE (µg/L)	cis-DCE (µg/L)	Trans-DCE (µg/L)	Vinyl Chloride (µg/L)
ANP-8	7/12/00	2.954	11.37	0.5 U[b]	0.5 U	2 U
ANP-8	8/22/00	3.223	12.58	0.5 U	0.5 U	2 U
GIN-4	7/19/00	3	7.615	0.5 U	0.5 U	2 U
GIN-4	8/1/00	1.962	6.779	0.5 U	0.5 U	2 U
MW-2	7/13/00	1 U	0.2213 J[c]	0.5 U	0.5 U	2 U
MW-2	8/1/00	1 U	0.2225 J	0.5 U	0.5 U	2 U
TAN-16	7/13/00	10.23	47.33	0.8816 J	1 U	4 U
TAN-16	8/1/00	5.146	34.96	1.085	0.4103 J	4 U
TAN-24A	7/19/00	1 U	0.5707 J	0.2284 J	0.5 U	2 U
TAN-24A	8/1/00	1 U	0.6166 J	0.5 U	0.5 U	2 U
TAN-47	7/10/00	1.593	3.512	0.5 U	0.5 U	2 U
TAN-47	7/18/00	1.306	2.468	0.5 U	0.5 U	2 U
TAN-47	8/15/00	0.7780 J	1.816	0.5 U	0.5 U	2 U
TAN-48	7/19/00	29.62	460.7	25.53	11.82	40 U
TAN-48	8/7/00	23.6	413.4	32.96	13.85	40 U
TAN-48 Dup	8/7/00	24.91	404.1	32.03	14.49	40 U
TAN-50	7/11/00	3.210	21.43	0.4905 J	0.5 U	2 U
TAN-50	7/25/00	4.595	19.92	0.5034	0.5 U	2 U
TAN-50	8/21/00	4.858	22.58	0.5 U	0.5 U	2 U
TAN-51	8/8/00	23.89	204.9	5.929	5 U	20 U
TAN-51	8/17/00	30.57	200.6	5 U	5 U	20 U
TAN-52	6/27/00	9.370	53.16	0.8265	0.2544 J	2 U
TAN-52	8/9/00	8.294	46.22	1.139	1 U	4 U
TAN-52	8/23/00	8.551	55.31	1.093	1 U	4 U

U = non-detect

J = estimated quantity.

3.2 Radionuclide Analyses

Radionuclide analyses included uranium isotopes and tritium. Data tables outlining the historical analytical results through FY 2000 annual monitoring are presented in Appendix B. As expected, the radionuclide concentrations are highest in the hot spot, decreasing with distance from TSF-05. Some well locations in the vicinity of the hot spot (TSF-05, TAN-25, and TAN-28) show increased concentrations of both uranium isotopes and tritium. The ISB annual report discusses the monitoring data and the implications of the treatability study on radionuclide mobilization. Table 3-5 shows specific analytical requirements and methods.

Table 3-5. Specific analytical requirements and methods for radionuclide analysis.

Analytical Parameter	Analytical Method	Laboratory Performing Analysis
Tritium	INEL-95/039 (INEL 1995)	Paragon Analytics, Inc., Fort Collins, Colorado
Uranium Isotopes	Guidance from ER-SOW-163	

3.3 Year 2000 Water Level Measurement Results

Water level measurements were collected on November 29, 2000, from monitoring wells in and surrounding TAN to track historical trends and monitor the hydraulic gradient. Water levels were measured using a single electronic water level indicator operated by one field technician. Readings were taken from each surveyed measuring point and subtracted from the measuring point's elevation to obtain the water elevation in feet above mean sea level (amsl). A table listing the water level elevations for the various wells is provided in Appendix A.

The water level measurements were taken from an area measuring approximately 12.9 km (8 mi) north-to-south by 10.5 km (6.5 mi) east-to-west and averaged approximately 1,394.7 m (4,575.8 ft) above mean sea level. An elevation high of 1,396.0 m (4,580.2) ft was observed at Well ANP-7, which is the area's northern most monitoring well. In contrast, an elevation low of 1,389.6 m (4,559.0 ft) was observed at Well OWSLEY-2 located in the area's extreme southeast corner. Using these elevation extremes, the area-wide gradient is 4.1E-4 from northwest to southeast. To the southeast, the gradient between Wells ANP-10 and OWSLEY-2 is calculated to be 4.3E-4.

Figure 3-2 illustrates the water table map based on the Calendar Year 2000 data. The map was created from an ASCII text file containing well coordinates and calculated water level elevations through Surfer^{R} for Windows, Version 6 computer software. (Note: No regional groundwater flow information was used to create this figure. Contours become less accurate as the distance from TAN increases.) No significant changes are observed since the previous annual collection event in 1999. The area to the north and west of the TAN facility exhibits a relatively flat groundwater table with a hydraulic gradient that averages about 1.2E-4. The area along the axis of the distal zone between Wells TAN-48 and TAN-24A has a hydraulic gradient of 2.9E-4.

Seasonal fluctuations in groundwater elevations do occur in the TAN area and average 4 ft. Figure 3-3 illustrates continuous groundwater elevation measurements taken from Well TAN-10A at 4-hour intervals from February to December 2000. An elevation high was recorded in May at 4,580.13 ft and an elevation low was recorded in October at 4,576.01 for a difference of 4.12 ft. Major changes in groundwater elevations (observed over months) are attributed to aquifer recharge fluctuations, while minor changes (observed over hours or days) are due to barometric pressure fluctuations.

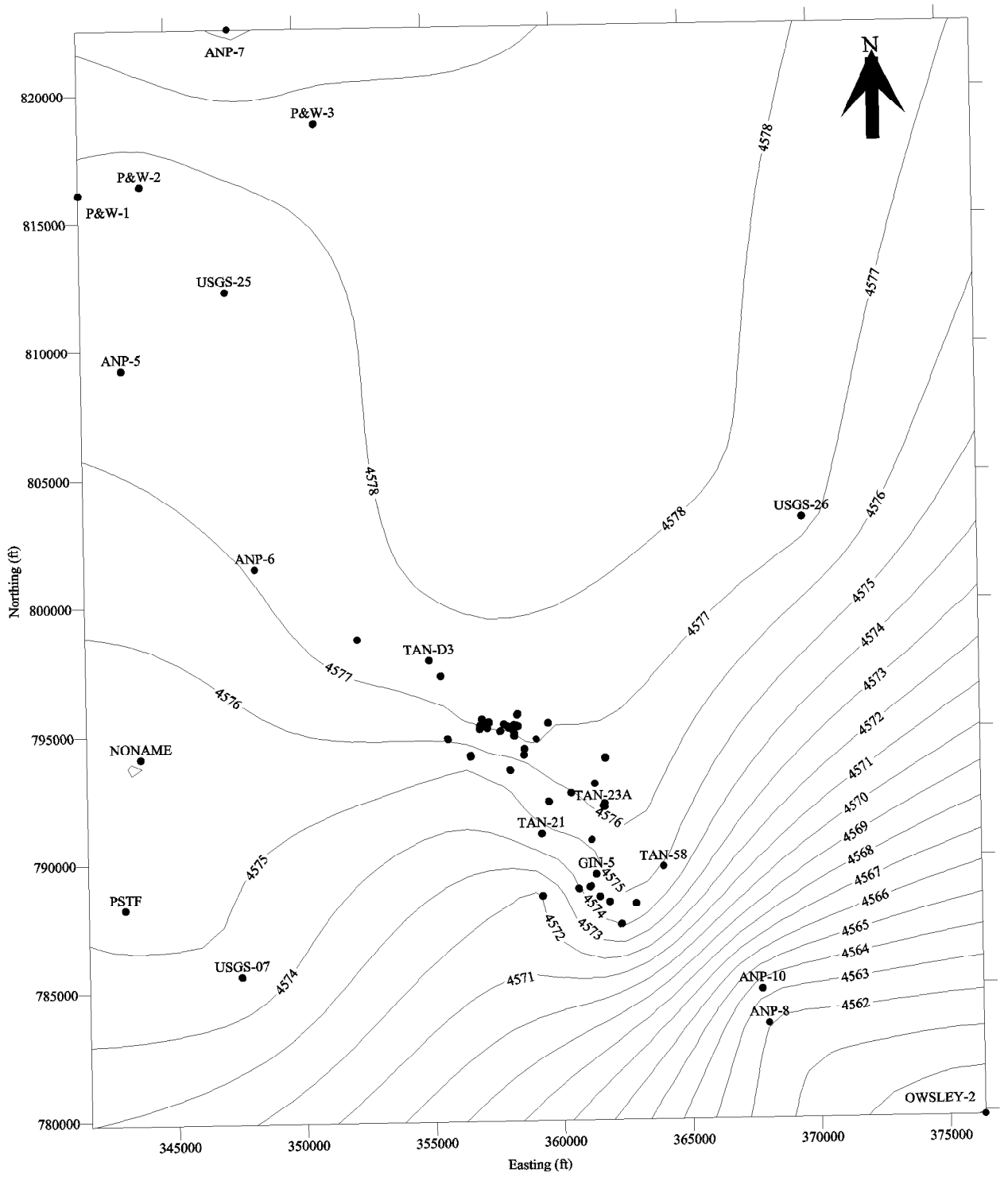

Figure 3-2. Regional scale water table map using Calendar Year 2000 annual water level survey data (contours expressed in feet above mean sea level).

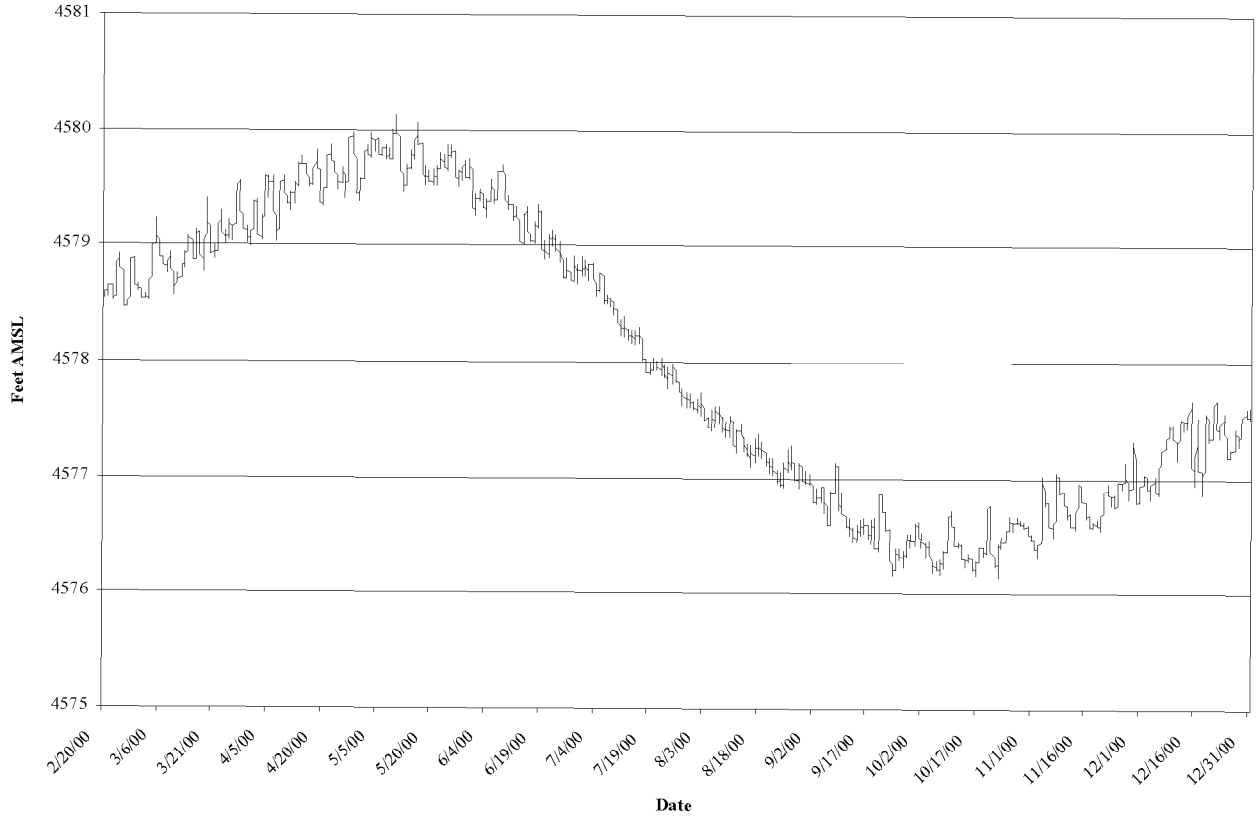

Figure 3-3. Water level elevations in Well TAN-10A from February to December 2000.

4. QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

The purpose of collecting and analyzing quality assurance (QA) and quality control (QC) samples is to confirm the achievement of project objectives and DQOs. The overall objectives associated with the TAN groundwater monitoring are discussed in the groundwater monitoring plan. The planned data uses, sampling design, types of analyses, required detection limits, precision, accuracy, completeness, and comparability needs are identified in the following sections. The evaluation of DQOs and the extent to which objectives were achieved are also discussed.

4.1 Precision and Accuracy

Variability, called sampling error, occurs during sample collection, handling, processing, and analysis. Concentrations of contaminants reported represent the true concentrations in the media sampled plus the measurement error, which can be minimized but not eliminated. Though it may not be significant in many cases, it is important to assess the contribution of measurement error to the total error in individual investigations. The analytical results of quality control samples are used to estimate accuracy and precision—the quantitative descriptions of measurement error.

4.1.1 Overall Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, precision is affected by sample collection procedures and by the natural heterogeneity of the matrix. Field precision is the difference between overall precision and laboratory precision. Overall precision (field and laboratory) can be evaluated by the use of duplicate samples collected in the field. Greater precision typically is required for chemicals with very low action levels that are close to background concentrations. Allowable laboratory precision for water samples is defined as having a relative percent difference (RPD) less than or equal to approximately 20%. Table 4-1 summarizes the overall precision for the groundwater monitoring conducted during FY 2000. The RPD was calculated only for those samples that were true positive values for both the initial sample and the field duplicate. As can be seen from the table, no RPDs for any analytes exceeded 20%.

Table 4-1. Overall precision by plume section.

Section	Analyte	Well	Sample	Duplicate	Units	RPD %
I	No duplicates collected					
II	Tetrachloroethene	USGS-24	39.02	43.50	µg/L	10.9
	Trichloroethene	USGS-24	619.0	603.7	µg/L	2.5
	cis-1,2-Dichloroethene	USGS-24	34.22	33.16	µg/L	3.1
	trans-1,2-Dichloroethene	USGS-24	13.30	14.89	µg/L	11.3
	Vinyl Chloride	USGS-24	40	40	µg/L	0.0
	Tritium	TAN-38	4,300	4,500	pCi/L	4.5
	Tritium	USGS-24	3,430	3,350	pCi/L	2.4
III	Tetrachloroethene	TAN-48	23.6	24.91	µg/L	5.4
	Trichloroethene	TAN-48	413.4	404.1	µg/L	2.3
	cis-1,2-Dichloroethene	TAN-48	32.96	32.03	µg/L	2.9

Table 4-1. (continued).

Section	Analyte	Well	Sample	Duplicate	Units	RPD %
	trans-1,2-Dichloroethene	TAN-48	13.85	14.49	µg/L	4.5
	Vinyl Chloride	TAN-48	40	40	µg/L	0.0
	Tetrachloroethene	TAN-D3	1	1	µg/L	0.0
	Trichloroethene	TAN-D3	0.7343	0.7456	µg/L	1.5
	cis-1,2-Dichloroethene	TAN-D3	0.5	0.5	µg/L	0.0
	trans-1,2-Dichloroethene	TAN-D3	0.5	0.5	µg/L	0.0
	Vinyl Chloride	TAN-D3	2	2	µg/L	0.0
	Tritium	TAN-48	3,420	3270	pCi/L	4.5
	Tritium	TAN-D3	<339	<339	pCi/L	0.0

4.1.2 Overall Accuracy

Accuracy is a measure of bias in a measurement system. Accuracy is affected by methods used for sample preservation, sample handling, and the sample matrix. The effects of the first three can be assessed by the evaluation of the results of field blanks, trip blanks, and equipment rinsates. The presence of a contaminant in the field blank, trip blank, or rinsate reveals that cross-contamination has occurred.

Laboratory accuracy is ensured through the use of standard methods and by employing the use of calibration standards traceable to the National Institute of Standards and Technology. All instrumentation is calibrated prior to use per the procedures outlined in the analytical methods and as required by the SMO statements of work. Laboratory accuracy is assessed through the use of matrix spikes and laboratory control samples. The number of laboratory QC samples is specified in the analytical methods employed and in the SMO statements of work (or task order statements of work). Evaluation criteria for the QC samples are specified in data validation TPRs for the SMO. For samples analyzed in accordance with Contract Laboratory Program protocol, validation is performed in accordance with that protocol.

The analytical accuracy of all the VOC samples was excellent. All VOC analyses done on blanks and rinsates were below detectable limits (see Table 4-2).

Only the radioactive elements tritium and uranium were measured in statistical sampling. Two rinsates and one field blank exhibited detectable activity: (1) a rinsate and a field blank yielded positive results for uranium isotopes and (2) a rinsate sample yielded positive results for tritium (Table 4-3). The three QA/QC sample results were from three different sample delivery groups.

The field blank (sample number 1WS005501UA from sample delivery group 1WS02601R8) exhibited an analytical result for ^{235}U of 0.207±0.0142 pCi/L with a minimum detectable activity (MDA) of 0.0439 pCi/L. The value exceeds the respective MDA by an order of magnitude and cannot be discounted.

The first rinsate (sample number 1WS06201UA from sample delivery group 1WS01701R8) exhibited an analytical result for ^{238}U of 0.0293 pCi/L, which is so close to the MDA that its error bar overlaps the MDA.

Table 4-2. VOC quality assurance/quality control data for the FY 2000 sampling program.

Sample Delivery Group Sample ID	Description	Date	VC (µg/L)	1,1-DCE (µg/L)	TCE (µg/L)	PCE (µg/L)	cis-DCE (µg/L)	trans-DCE (µg/L)
1WS02401VE								
1WS08301VA	Trip Blank	8-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS03001VA								
1WS08001VA	Trip Blank	19-Jul-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS05601VA	Field Blank	19-Jul-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS02101VA								
1WS08501VA	Trip Blank	17-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS05701VA	Field Blank	17-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS06301VA	Rinsate	16-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS03101VA								
1WS08401VA	Trip Blank	15-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS08801VA								
1WS08801VA	Trip Blank	10-Oct-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS03401VA								
1WS08601VA	Trip Blank	21-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS05501VA								
1WS06001VA	Trip Blank	27-Jun-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS05501VA	Field Blank	26-Jun-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS06101VA	Rinsate	27-Jun-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS05401VE								
1WS08201VA	Trip Blank	2-Aug-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS06201VA								
1WS08101VA	Trip Blank	25-Jul-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS06201VA	Rinsate	25-Jul-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U
1WS07901VA								
1WS07901VA	Trip Blank	13-Jul-00	2 U	1 U	1 U	1 U	0.5 U	0.5 U

U = non-detect

Table 4-3. Tritium/uranium quality assurance/quality control data for the FY 2000 sampling program.

Sample Delivery Group Sample ID	Description	Date	Analysis	pCi/L	+/-	MDA
1WS01401R8						
1WS05601UA	Field Blank	5-Jul-00	U-234	0.0204	0.0152	0.0567
1WS05601UA	Field Blank	5-Jul-00	U-235	0.0160	0.0130	0.0500
1WS05601UA	Field Blank	5-Jul-00	U-238	-0.000436	0.00986	0.0625
1WS01701R8						
1WS06201UA	Rinsate	25-Jul-00	U-234	0.0127	0.0128	0.0510
1WS06201UA	Rinsate	25-Jul-00	U-235	-0.00158	0.00719	0.0392
1WS06201UA	Rinsate	25-Jul-00	U-238	0.0293	0.0114	0.0250
1WS05601R8	Field Blank	19-Jul-00	Tritium	83.1	99.3	331
1WS06201R8	Rinsate	25-Jul-00	Tritium	-37.7	97.1	330
1WS00601R8						
1WS09001R8	Field Blank	10-Oct-00	Tritium	-41.7	81.7	275
1WS02601R8						
1WS05501UA	Field Blank	5-Jun-00	U-234	0.0349	0.177	0.0590
1WS05501UA	Field Blank	5-Jun-00	U-235	0.270	0.0142	0.0439
1WS05501UA	Field Blank	5-Jun-00	U-238	0.0203	0.0113	0.0318
1WS00101R8						
1WS06101UA	Rinsate	27-Jun-00	U-234	0.0295	0.0155	0.0522
1WS06101UA	Rinsate	27-Jun-00	U-235	0.0179	0.0123	0.0452
1WS06101UA	Rinsate	27-Jun-00	U-238	0.0168	0.0108	0.0361
1WS05501R8	Field Blank	26-Jun-00	Tritium	66.4	102	339
1WS06101R8	Rinsate	27-Jun-00	Tritium	3160	242	339
1WS02101R8						
1WS05701UA	Field Blank	17-Aug-00	U-234	0.00113	0.0112	0.0591
1WS05701UA	Field Blank	17-Aug-00	U-235	-0.00113	0.00763	0.0439
1WS05701UA	Field Blank	17-Aug-00	U-238	0.00901	0.00813	0.0318
1WS06301UA	Rinsate	16-Aug-00	U-234	0.0153	0.0103	0.0333
1WS06301UA	Rinsate	16-Aug-00	U-235	0.00589	0.00799	0.0160
1WS06301UA	Rinsate	16-Aug-00	U-238	0.00943	0.00851	0.0333
1WS05701R8	Field Blank	17-Aug-00	Tritium	-70.9	86.8	294
1WS06301R8	Rinsate	16-Aug-00	Tritium	-53.2	87.0	294

The second and final rinsate of interest (sample number 1WS06101R8 from sample delivery group 1WS00101R8) exhibited an analytical result for tritium of 3160±242 pCi/L with a MDA of 339 pCi/L. Like the field blank previously discussed, the value exceeds the respective MDA by an order of magnitude and cannot be discounted. A recheck of the reported analytical results for Paragon Analytics, Inc. Laboratory showed that sample number 1WS06101R8 was analyzed for tritium on July 9, 2000, and reported the result of 3.16E+03 with a sample uncertainty of 2.42E+02 and a MDA of 3.39E+02. Other reported analytical results within the same sample delivery group (SDG) are:

Sample Source	Analysis Type	Sample Value	Sample Uncertainty	Units	MDA
TAN-48	H-3	2.53E+02	1.06+02	pCi/L	3.39E+02
TAN-51	H-3	1.31E+03	1.44E+02	pCi/L	3.39E+02
TAN-33	H-3	3.32E+03	2.51E+02	pCi/L	3.39E+02
Field Blank	H-3	6.64E+01	1.02E+02	pCi/L	3.39E+02
USGS-24	H-3	3.17E+03	2.43E+02	pCi/L	3.39E+02
TAN-52	H-3	3.85E+02	1.09E+02	pCi/L	3.39E+02
TAN-D3	H-3	9.30E+01	1.02E+02	pCi/L	3.39E+02
TAN-D3	H-3	5.76E+01	1.02E+01	pCi/L	3.39E+02

Within the sample delivery group, analytical results for TAN-33 and USGS-24 were of similar values to the rinsate sample in question. It is very unlikely to have a rinsate sample result with such a high value because any decontamination effort would have diluted the sample collected, resulting in a much lower sample result as compared to those in the SDG. However, field technician logs are sufficiently lacking to determine what kind of equipment was decontaminated, where the equipment was used prior to decontamination, how decontamination was performed, and where the equipment was used after decontamination. Possible explanations for the analytical result for tritium for this rinsate sample are laboratory reporting error, laboratory or field cross-contamination, or the most likely explanation–– sample switching or sample mislabeling either in the field or at the laboratory.

4.1.3 Completeness

Completeness is a measure of the quantity of usable data collected during an investigation. The groundwater monitoring plan requires an overall completeness goal of 90% for this project.

For FY 2000, a total of 24 wells were to be sampled during the course of the year. These wells were sampled according to the methodology outlined in the groundwater monitoring plan for OU 1-07B. Three sections were defined based on concentration gradients in the TCE plume. All of the wells detailed in the plan were sampled except for Wells TAN-54 and -55, which were under construction and unavailable for sampling. A total of 135 analytical samples were planned and 112 analytical samples were collected. This yields a completeness of 83%. The only samples not collected were those from TAN-54 and TAN-55 as they had not been properly developed in time for sampling to occur during FY 2000 and two of the three triplicate samples planned for TSF-05 due to equipment stack down-hole.

The groundwater monitoring plan called for field duplicates and field blanks to be taken at a rate of 1 per 20 samples. Field duplicates were actually collected at a rate of 1 every 17.25 samples and field blanks were actually collected at a rate of 1 every 13.8 samples. Rinsates were scheduled to be collected

at a rate of 1 per 20 samples. Of the 22 wells, ten wells did not contain dedicated purging/sampling equipment. These wells accounted for 22 sampling events requiring the decontamination and use of portable purging/sampling equipment. For these 22 sampling events, rinsate samples were collected at a rate of 1 every 7.3 samples.

4.1.4 Comparability and Representativeness

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. As a minimum, comparable data must be obtained using unbiased sample designs. If sampling designs are not unbiased, the reasons for selecting another design should be well documented. Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data reflect the characteristics being measured. The representativeness criterion is best satisfied by confirming that sampling locations are selected properly and a sufficient number of samples are collected to meet the confidence level required by the intended use of the data.

Data comparability was ensured through the use of standard sample collection techniques with adherence to QA/QC in accordance with the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (Department of Energy Idaho Operations Office [DOE-ID] 1997), the use of field QC samples, and the use of standard analytical methods by the laboratories. The data collected for each well are intended to supplement existing monitoring data in support of the remedial action goals of the project. Therefore, the combined knowledge obtained from all of those sources ensures that the data collected are representative of some averaged portion of aquifer.

4.1.5 Replicate Sampling

One of the objectives of statistical sampling is to estimate sources of variability in measured values (INEEL 1999). Analytical data were gathered to be able to assess the variability in the overall sampling and analysis procedure by repeatedly sampling a subset of wells in the monitoring network. The subset comprised 14 wells and included:

- ANP-8
- TAN-28
- TAN-52
- GIN-4
- TAN-30A
- USGS-24
- MW-2
- TAN-47
- TAN-16
- TAN-48
- TAN-24A

- TAN-50
- TAN-25
- TAN-51.

The plan called for these wells to be sampled in triplicate over approximately 2 months with each sampling event to include the entire sampling process of setting a pump (for non-dedicated pumping systems), purging, and sample collection. The underlying assumption was that the analytical concentrations will be the same during each of the three sample collection events; thus, any observed concentration differences will represent variability due to the sampling and analytical process. The following table lists the replicates planned and sampled. Analysis and interpretation of the replicate data will be presented in the Periodic Remedy Performance Report to be written in FY 2002.

4.1.6 Sample Delivery Groups

A sample delivery group (SDG) includes samples collected within a timeframe not to exceed 14 calendar days (see Tables 4-4 and 4-5). The samples can be collected from any well, and the SDG can contain trip and field blanks and rinsate samples. The actual number of samples in the group typically range from three to nine and can be as high as 20 samples per SDG. One of the sample numbers within the SDG is used to identify the SDG by the receiving laboratory. Quality assurance is provided for each SDG by including trip and field blanks, which are comprised of deionized water containing preservatives per sample analysis requirements.

	WELL ANP 8			WELL GIN 4			WELL MW 2			WELL TAN 16			WELL TAN 24A		
DATA SOURCE:	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL	INEEL
ANALYTE\DATE	6/12/00	7/12/00	8/22/00	6/12/00	7/19/00	8/1/00	6/13/00	7/13/00	8/1/00	6/14/00	7/13/00	8/1/00	6/12/00	7/19/00	8/1/00
VOCs		1WS02701VA	1WS02801VA		1WS04701VA	1WS04801VA		1WS05301VA	1WS05401VE		1WS04401VA	1WS04501VA		1WS05001VA	1WS05101VA
PCE (µg/L)		2.954	3.223		3	1.962		1 U	1 U		10.23	5.146		1 U	1 U
TCE (µg/L)		11.37	12.58		7.615	6.779		0.2213 J	0.2225 J		47.33	34.96		0.5707 J	0.6166 J
cis-1,2-DCE (µg/L)		0.5 U	0.5 U		0.5 U	0.5 U		0.5 U	0.5 U		0.8816 J	1.085		0.2284 J	0.5 U
trans-1,2-DCE (µg/L)		0.5 U	0.5 U		0.5 U	0.5 U		0.5 U	0.5 U		1 U	0.4103 J		0.5 U	0.5 U
total-1,2-DCE (µg/L)															
vinyl chloride (µg/L)		2 U	2 U		2 U	2 U		2 U	2 U		4 U	4 U		2 U	2 U
Ethene (µg/L)															
Ethane (µg/L)															
Methane (µg/L)															
Hydrogen Sulfide															
RADIONUCLIDES (pCi/L)	1WS02601R3	1WS02701R3	1WS02801R3	1WS04601R3	1WS04701R3	1WS04801R3	1WS05301R3	1WS05301R3	1WS05401R3	1WS04301R3	1WS04401R3	1WS04501R3	1WS04901R3	1WS05001R3	1WS05101R3
^{3}H	<266	<271	<293	<266	<331	<273	<266	<271	<273	<266	<271	<273	<266	<331	<273
^{90}Sr															
^{137}Cs															
Gross Alpha															
Gross Beta															
^{234}U															
$^{230}Th/^{234}U$															
^{235}U															
^{238}U															

Figure 4-1. Replicates–planned and sampled.

	WELL TAN 25				WELL TAN 28				WELL TAN 30A				WELL TAN 47			
DATA SOURCE:	INEEL	INEEL	INEEL		INEEL	INEEL	INEEL		INEEL	INEEL	INEEL		INEEL	INEEL	INEEL	
ANALYTE\DATE	6/5/00	7/6/00	7/31/00	Std dev.	6/5/00	7/5/00	8/28/00	Std dev.	6/5/00	7/5/00	7/31/00	Std dev.	7/10/00	7/18/00	8/15/00	Std dev.
VOCs	1PD11501VA	1PD14601VA	1PD17101VA		1PD12101VA	1PD15101VA	1PD20101VA		1PD12201VA	1PD15201VE	1PD17701VA		1WS02901VA	1WS03001VA	1WS03101VA	
PCE (µg/L)	-	<10	-		<10	<10	<10		<10	12.2	<10		1.593	1.306	0.7780 J	0.3375365
TCE (µg/L)	<10	<10	<10		621.9	579.4	768.3	80.913136	177.6	202.8	192.4	10.33999785	3.512	2.468	1.816	0.6985267
cis-1,2-DCE (µg/L)	43.1	22.7	69.5	19.1583	187.5	173.4	192.3	8.0212219	43.0	48.3	47.8	2.389328125	0.5 U	0.5 U	0.5 U	
trans-1,2-DCE (µg/L)	423.4	398.8	490.5	38.7534	134.2	122.4	144.5	9.0292119	35.5	33.2	35.5	1.084230398	0.5 U	0.5 U	0.5 U	
total-1,2-DCE (µg/L)																
vinyl chloride (µg/L)	<10	<10	42.0		<10	<10	<10		<10	<10	<10		2 U	2 U	2 U	
Ethene (µg/L)	117.9	88.7	96.5		<1	<1	0.5		-	-	-					
Ethane (µg/L)	1.0	-	-		-	-	-		-	-	-					
Methane (µg/L)	8781.6	9727.3	9512.5	404.791	856.2	1124.5	2428.3	686.64868	2407.3	2061.4	2668.6	248.689083				
Hydrogen Sulfide																
RADIONUCLIDES (pCi/L)	1PD11501R8	1PD14601R8	1PD19601R8		1PD12101R8	1PD15101R8	1PD20101R8		1PD12201R8	1PD15201R8	1PD17701R8		1WS02901R8	1WS03001R8	1WS03101R8	
^{3}H	2560+/-192	3500+/-225	4080+/-331		3670+/-240	4030+/-254	4770+/-373		3380+/-229	3620+/-232	3140+/-215		<272	<331	<294	
^{90}Sr																
^{137}Cs																
Gross Alpha																
Gross Beta																
	1WS07301UA	1WS07401UA	1WS07501UA						1WS07601UA	1WS07701UA	1WS07801UA					
^{234}U	1.01+/-0.1	3.37+/-0.26	1.34+/-0.14**						2.4+/-0.2	2.42+/-0.2	2.63+/-0.22**					
$^{230}Th/^{234}U$																
^{235}U	0.11+/-0.03	0.13+/-0.03	0.052+/-0.023**						0.129+/-0.03	0.111+/-0.03	0.131+/-0.035**					
^{238}U	0.134+/-0.03	0.335+/-0.05	.02+/-0.044**						0.866+/-0.09	0.78+/-0.08	0.947+/-0.112**					

Figure 4-1. (continued).

	WELL TAN 48						WELL TAN 50				WELL TAN 51			
				DUP										
DATA SOURCE:	INEEL	INEEL	INEEL	INEEL	AVERAGE		INEEL	INEEL	INEEL		INEEL	INEEL	INEEL	
ANALYTE\DATE	6/19/00	7/19/00	8/7/00	8/7/00	8/7/00	Std dev.	7/11/00	7/25/00	8/21/00	Std dev.	6/20/00	8/8/00	8/17/00	Std dev.
VOCs		1WS01701VA	1WS01801VA	1WS01802VA			1WS03201VA	1WS03301VA	1WS03401VA			1WS02001VA	1WS02101VA	
PCE (µg/L)		29.62	23.6	24.91	24.255	2.6825	3.210	4.595	4.858	0.72290294		23.89	30.57	3.34
TCE (µg/L)		460.7	413.4	404.1	408.75	25.975	21.43	19.92	22.58	1.08925051		204.9	200.6	2.15
cis-1,2-DCE (µg/L)		25.53	32.96	32.03	32.495	3.4825	0.4905 J	0.5034	0.5 U			5.929	5 U	
trans-1,2-DCE (µg/L)		11.82	13.85	14.49	14.17	1.175	0.5 U	0.5 U	0.5 U			5 U	5 U	
total-1,2-DCE (µg/L)														
vinyl chloride (µg/L)		40 U	40 U	40 U			2 U	2 U	2 U			20 U	20 U	
Ethene (µg/L)														
Ethane (µg/L)														
Methane (µg/L)														
Hydrogen Sulfide														
RADIONUCLIDES (pCi/L)	1WS01601R8	1WS01701R8	1WS01801R8	1WS01802R8			1WS03201R8	1WS03301R8	1WS03401R8		1WS01901R8	1WS02001R8	1WS02101R8	
^{3}H	<339	3340+/-254	3420+/-243	3270+/-234			<272	<330	<293		<339	1390+/-130	1280+/-130	
^{90}Sr														
^{137}Cs														
Gross Alpha														
Gross Beta														
^{234}U														
$^{230}Th/^{234}U$														
^{235}U														
^{238}U														

Figure 4-1. (continued).

	WELL TAN 52				USGS 24					
							DUP			
DATA SOURCE:	INEEL	INEEL	INEEL		INEEL	INEEL	INEEL	AVERAGE	INEEL	
ANALYTE\DATE	6/27/00	8/9/00	8/23/00	Std dev.	6/26/00	7/12/00	7/12/00	7/12/00	8/2/00	Std dev.
VOCs	1WS02301VA	1WS02401VE	1WS02501VA		1WS01301VA	1WS01401VA	1WS01402VA		1WS01501VA	
PCE (µg/L)	9.370	8.294	8.551	0.4588132	44.48	39.02	43.50	41.26	29.04	6.650734
TCE (µg/L)	53.16	46.22	55.31	3.87892024	379.9	619.0	603.7	611.35	539.0	96.67611
cis-1,2-DCE (µg/L)	0.8265	1.139	1.093	0.13775764	29.33	34.22	33.16	33.69	47.53	7.758832
trans-1,2-DCE (µg/L)	0.2544 J	1 U	1 U		12.69	13.30	14.89	14.10	20.06	3.194999
total-1,2-DCE (µg/L)										
vinyl chloride (µg/L)	2 U	4 U	4 U		2 U	40 U	40 U		40 U	
Ethene (µg/L)										
Ethane (µg/L)										
Methane (µg/L)										
Hydrogen Sulfide										
RADIONUCLIDES (pCi/L)	1WS02301R8	1WS02401R8	1WS02501R8		1WS01301R8	1WS01402R8	1WS01401R8		1WS01501R8	
^{3}H	385+/-109	284+/-86.4	<293		3170+/-243	3430+/-243	3350+/-238		3670+/-257	
^{90}Sr										
^{137}Cs										
Gross Alpha										
Gross Beta										
^{234}U										
$^{230}Th/^{234}U$										
^{235}U										
^{238}U										

Figure 4-1. (continued).

Table 4-4. Sample delivery groups and samples collected for VOC analysis.

Sample Delivery Group / Sample ID	Location	Date
1WS02401VE		
1WS01801VA	TAN-48	7-Aug-00
1WS01802VA	TAN-48	7-Aug-00
1WS02001VA	TAN-51	8-Aug-00
1WS02401VE	TAN-52	9-Aug-00
1WS08301VA	Trip Blank	8-Aug-00
1WS03001VA		
1WS04701VA	GIN-4	19-Jul-00
1WS05001VA	TAN-24A	19-Jul-00
1WS03001VA	TAN-47	18-Jul-00
1WS01701VA	TAN-48	19-Jul-00
1WS08001VA	Trip Blank	19-Jul-00
1WS05601VA	Field Blank	19-Jul-00
1WS02101VA		
1WS02101VA	TAN-51	17-Aug-00
1WS08501VA	Trip Blank	17-Aug-00
1WS05701VA	Field Blank	17-Aug-00
1WS06301VA	Rinsate	16-Aug-00
1WS03101VA		
1WS03101VA	TAN-47	15-Aug-00
1WS08401VA	Trip Blank	15-Aug-00
1WS08801VA		
1WS01101VA	TAN-38	10-Oct-00
1WS00901VA	TAN-39	11-Oct-00
1WS00601VE	TAN-40	12-Oct-00
1WS08801VA	Trip Blank	10-Oct-00
1WS03401VA		
1WS02801VA	ANP-8	22-Aug-00
1WS03401VA	TAN-50	21-Aug-00
1WS02501VA	TAN-52	23-Aug-00
1WS08601VA	Trip Blank	21-Aug-00
1WS06201VA		
1WS03301VA	TAN-50	25-Jul-00
1WS08101VA	Trip Blank	25-Jul-00
1WS06201VA	Rinsate	25-Jul-00
1WS07901VA		
1WS02701VA	ANP-8	12-Jul-00
1WS05301VA	MW-2	13-Jul-00
1WS04401VA	TAN-16	13-Jul-00
1WS02901VA	TAN-47	10-Jul-00
1WS03201VA	TAN-50	11-Jul-00
1WS01401VA	USGS-24	12-Jul-00
1WS01402VA	USGS-24	12-Jul-00
1WS07901VA	Trip Blank	13-Jul-00
1WS05401VE		
1WS04801VA	GIN-4	1-Aug-00
1WS05401VE	MW-2	1-Aug-00
1WS04501VA	TAN-16	1-Aug-00
1WS05101VA	TAN-24A	1-Aug-00
1WS01501VA	USGS-24	2-Aug-00
1WS08201VA	Trip Blank	2-Aug-00
1WS05501VA		
1WS00101VA	D-3	28-Jun-00
1WS00102VA	D-3	28-Jun-00
1WS01201VA	TAN-33	26-Jun-00
1WS02301VA	TAN-52	27-Jun-00
1WS01301VA	USGS-24	26-Jun-00
1WS06001VA	Trip Blank	27-Jun-00
1WS05501VA	Field Blank	26-Jun-00
1WS06101VA	Rinsate	27-Jun-00

Table 4-5. Sample delivery groups and samples collected for radiological analysis.

Sample Delivery Group / Sample ID	Location	Date
1WS01401R8		
1WS02701R8	ANP-8	12-Jul-00
1WS05301R8	MW-2	13-Jul-00
1WS04401R8	TAN-16	13-Jul-00
1WS07401UA	TAN-25	6-Jul-00
1WS07701UA	TAN-30A	5-Jul-00
1WS02901R8	TAN-47	10-Jul-00
1WS03201R8	TAN-50	11-Jul-00
1WS01401R8	USGS-24	12-Jul-00
1WS01402R8	USGS-24	12-Jul-00
1WS05601UA	Field Blank	5-Jul-00
1WS01701R8		
1WS04701R8	GIN-4	19-Jul-00
1WS05001R8	TAN-24A	19-Jul-00
1WS03001R8	TAN-47	18-Jul-00
1WS01701R8	TAN-48	19-Jul-00
1WS03301R8	TAN-50	25-Jul-00
1WS05601R8	Field Blank	19-Jul-00
1WS06201R8	Rinsate	25-Jul-00
1WS06201UA	Rinsate	25-Jul-00
1WS00601R8		
1WS01101R8	TAN-38	10-Oct-00
1WS01102R8	TAN-38	10-Oct-00
1WS00901R8	TAN-39	11-Oct-00
1WS00601R8	TAN-40	12-Oct-00
1WS09001R8	Field Blank	10-Oct-00
1WS01501R8		
1WS04801R8	GIN-4	1-Aug-00
1WS05401R8	MW-2	1-Aug-00
1WS04501R8	TAN-16	1-Aug-00
1WS05101R8	TAN-24A	1-Aug-00
1WS01801R8	TAN-48	7-Aug-00
1WS00101R8		
1WS00101R8	D-3	28-Jun-00
1WS00102R8	D-3	28-Jun-00
1WS01201R8	TAN-33	26-Jun-00
1WS01601R8	TAN-48	19-Jun-00
1WS01901R8	TAN-51	20-Jun-00
1WS02301R8	TAN-52	27-Jun-00
1WS01301R8	USGS-24	26-Jun-00
1WS05501R8	Field Blank	26-Jun-00
1WS06101R8	Rinsate	27-Jun-00
1WS06101UA	Rinsate	27-Jun-00
1WS02101R8		
1WS02801R8	ANP-8	22-Aug-00
1WS03101R8	TAN-47	15-Aug-00
1WS03401R8	TAN-50	21-Aug-00
1WS02101R8	TAN-51	17-Aug-00
1WS02501R8	TAN-52	23-Aug-00
1WS05701R8	Field Blank	17-Aug-00
1WS06301R8	Rinsate	16-Aug-00
1WS05701UA	Field Blank	17-Aug-00
1WS06301UA	Rinsate	16-Aug-00
1WS02601R8		
1WS02601R8	ANP-8	12-Jun-00
1WS04601R8	GIN-4	12-Jun-00
1WS05201R8	MW-2	13-Jun-00
1WS04101R8	TAN-15	12-Jun-00
1WS04301R8	TAN-16	14-Jun-00
1WS04901R8	TAN-24A	12-Jun-00
1WS07301UA	TAN-25	5-Jun-00
1WS07601UA	TAN-30A	5-Jun-00
1WS07001UA	TSF-05B	5-Jun-00
1WS05501UA	Field Blank	5-Jun-00

Table 4-5. (continued).

Sample Delivery Group Sample ID	Location	Date
1WS01802R8	TAN-48	7-Aug-00
1WS02001R8	TAN-51	8-Aug-00
1WS02401R8	TAN-52	9-Aug-00
1WS01501R8	USGS-24	2-Aug-00
1WS07501UA	TAN-25	31-Jul-00
1WS07801UA	TAN-30A	31-Jul-00

Sample Delivery Group Sample ID	Location	Date

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Appendix A

Water Level Elevations

Appendix A

Water Level Evaluations

Well	Measuring Point Elevation (ft amsl)	Depth to Water (ft)	Water Elevation (ft amsl)	Measuring Point Coordinates Easting NAD27	Measuring Point Coordinates Northing NAD27
ANP-5	4,874.65	297.2	4,577.38	343,175.750	809,231.750
ANP-6	4,797.05	219.9	4,577.06	348,250.230	801,438.910
ANP-7	4,936.68	356.4	4,580.20	347,497.850	822,497.790
ANP-8	—	—	no access	362,702.200	789,215.640
ANP-9	4,788.24	226.3	4,561.88	367,997.796	783,502.894
ANP-10	4,787.64	224.4	4,563.23	367,747.130	784,857.570
FET-Disposal	4,785.85	208.2	4,577.59	352,200.948	798,650.985
GIN-1	4,788.11	214.1	4,573.99	360,674.020	788,853.580
GIN-2	4,787.87	213.1	4,574.77	361,168.290	788,929.610
GIN-3	4,788.43	213.9	4,574.53	361,484.100	788,531.350
GIN-4	4,788.08	213.4	4,574.63	361,118.680	788,922.000
GIN-5	4,788.31	213.4	4,574.82	361,355.940	789,392.610
IET Disp	—	—	no access	358,959.910	801,549.280
MW-2	4,789.43	214.8	4,574.54	361,861.561	788,336.662
NONAME(TANexpl)	4,786.00	211.0	4,574.93	343,701.210	794,100.610
OWSLEY-2	4,785.95	227.0	4,558.95	376,358.720	779,820.650
P&W-1	4,897.22	319.4	4,577.73	341,603.880	816,095.750
P&W-2	4,892.91	315.4	4,577.48	344,004.130	816,397.130
P&W-3	4,887.43	308.9	4,578.52	350,802.530	818,797.240
PSTF	4,788.23	212.9	4,575.33	343,020.010	788,226.670
TANT-MON-A-01	4,782.08	204.6	4,577.48	355,416.582	797,204.635
TAN-04	4,803.61	226.4	4,577.12	358,377.040	795,682.600
TAN-05	4,804.03	227.0	4,576.97	358,352.560	795,647.530
TAN-06	4,788.73	212.0	4,576.69	361,771.410	793,961.520
TAN-07	4,788.65	211.9	4,576.72	361,767.370	793,915.400
TAN-08	4,791.58	216.2	4,575.33	358,066.660	793,502.290
TAN-09	4,782.62	205.1	4,577.49	356,987.030	795,491.090
TAN-10A	4,782.63	205.5	4,577.12	356,921.780	795,239.780

Well	Measuring Point Elevation (ft amsl)	Depth to Water (ft)	Water Elevation (ft amsl)	Measuring Point Coordinates Easting NAD27	Northing NAD27
TAN-11	4,782.83	205.5	4,577.28	356,930.860	795,160.070
TAN-12	4,782.78	205.5	4,577.27	356,904.390	795,122.280
TAN-13A	4,782.41	207.2	4,575.19	356,524.680	794,111.240
TAN-14	4,782.69	207.4	4,575.25	356,549.390	794,053.810
TAN-15	4,788.88	212.6	4,576.25	361,712.310	792,165.140
TAN-16	4,788.81	212.5	4,576.30	361712.820	792,120.170
TAN-18	4,804.37	227.1	4,577.18	358,254.767	795,251.042
TAN-19	4,805.67	228.4	4,577.19	358,236.250	795,265.720
TAN-20	4,782.88	206.7	4,576.09	355,660.720	794,753.040
TAN-21	4,789.20	214.3	4,574.86	359,254.620	791,009.260
TAN-22A	4,788.76	212.1	4,576.58	361,724.740	792,012.370
TAN-23A	4,788.60	212.4	4,576.18	361,668.550	792,050.420
TAN-24A	4,790.93	216.0	4,574.84	362,886.290	788,264.450
TAN-26	—	—	no access	357,040.674	795,372.074
TAN-27	4,782.41	205.2	4,577.21	357,205.808	795,158.214
TAN-28	4,784.02	206.8	4,577.17	357,259.363	795,380.274
TAN-29	—	—	no access	357,508.061	795,330.841
TAN-30A	4,784.03	206.7	4,577.28	357,267.610	795,362.801
TAN-31	4,784.94	207.3	4,577.57	356,994.224	795,450.519
TAN-32	4,787.42	210.3	4,577.12	357,706.260	795,024.827
TAN-33	4,800.41	223.2	4,577.16	358,324.780	795,238.856
TAN-34	—	—	no access	357,749.124	795,197.740
TAN-35	—	—	no access	357,707.105	795,225.241
TAN-36	4,796.35	219.3	4,577.03	358,257.728	794,843.194
TAN-37	4,784.35	206.9	4,577.4	357,143.367	795,366.759
TAN-38	—	—	no access	358,232.857	795,047.455
TAN-39	—	—	no access	358,063.400	795,156.115
TAN-40	—	—	no access	357,861.665	795,288.419
TAN-41	4,785.94	208.7	4,577.19	357,839.889	795,281.551
TAN-42	4,802.58	225.4	4,577.18	357,986.878	795,200.288
TAN-43	4,801.78	224.5	4,577.19	358,050.712	795,139.229

Well	Measuring Point Elevation (ft amsl)	Depth to Water (ft)	Water Elevation (ft amsl)	Measuring Point Coordinates Easting NAD27	Northing NAD27
TAN-44	4,800.75	223.5	4,577.16	358,213.848	795,039.999
TAN-45	4,797.71	220.6	4,577.11	358,245.832	794,936.133
TAN-46	4,796.36	219.2	4,577.08	358,239.565	794,840.276
TAN-47	4,790.51	214.3	4,576.20	358,611.897	794,104.139
TAN-48	4,790.20	213.1	4,577.03	359,107.267	794,694.047
TAN-49	—	—	no access	357,557.110	795,323.310
TAN-50	4,790.84	213.8	4,577.01	359,566.774	795,322.389
TAN-51	4,788.59	212.6	4,575.94	360,428.312	792,595.274
TAN-52	4,788.00	213.0	4,575.00	361,210.435	790,733.954
TAN-53	—	—	no access	358,810.217	794,876.241
TAN-54	4,789.36	213.7	4,575.62	359,548.557	792,269.334
TAN-55	4,789.64	213.2	4,576.36	361,349.177	792,923.404
TAN-56	4,790.05	215.7	4,574.32	362,305.359	787,451.051
TAN-57	4,790.30	218.6	4,571.70	359,255.149	788,588.312
TAN-58	4,791.7	216.6	4,575.08	363,976.389	789,664.800
TAN-D1	4,789.21	212.0	4,577.19	358,628.150	794,347.040
TAN-D2	4,783.11	205.6	4,577.48	356,957.560	795,507.940
TAN-D3	4,780	202.4	4,577.57	354,966.610	797,824.540
TSF-05	—	—	no access	356,999.490	795,400.900
USGS-07	4,790.81	216.0	4,574.77	347,517.780	785,570.360
USGS-24	4,796.99	219.8	4,577.17	358,397.170	795,213.830
USGS-25	4,850.87	273.5	4,577.36	347,254.460	812,272.220
USGS-26	4,790.65	213.3	4,577.33	369,554.530	803,222.190